PHYSICS AND ENGINEERING

The Physics and Engineering Department (https://ccri.edu/physandengr/engt/) offers a dynamic and comprehensive curriculum designed to serve students at various stages of their academic and career journeys. The department provides general education courses that develop critical thinking and problem-solving skills essential for a wide range of disciplines. The department offers terminal associate degrees in advanced manufacturing and applied engineering and energy systems to prepare students to enter the workforce upon graduation, along with transfer degrees in engineering and physics, to prepare students for further study at four-year universities.

Additionally, specialized, stackable certificates in manufacturing and design are available for those looking to enter the workforce directly with practical, industry-relevant skills. With a focus on hands-on learning, rigorous coursework, and a strong foundation in scientific principles, the department ensures students are well-equipped for success in both academic pursuits and professional careers in science, engineering, and technology.

Programs

Associate Degree Programs

- Advanced Manufacturing and Design - Associate in Science (https://catalog.ccri.edu/programs-study/physics-engineering/assoc/advanced-manufacturing-technology-as/)
- Applied Engineering and Energy Systems - Associate in Science (https://catalog.ccri.edu/programs-study/physics-engineering/assoc/applied-engineering-energy-systems-as/)
- Engineering, Biomedical - Associate in Science in Engineering (https://catalog.ccri.edu/programs-study/physics-engineering/assoc/engineering-biomedical-ase/)
- Engineering, Chemical - Associate in Science in Engineering (https://catalog.ccri.edu/programs-study/physics-engineering/assoc/engineering-chemical-as/)
- Engineering, Civil - Associate in Science in Engineering (https://catalog.ccri.edu/programs-study/physics-engineering/assoc/engineering-civil-ase/)
- Engineering, Computer - Associate in Science in Engineering (https://catalog.ccri.edu/programs-study/physics-engineering/assoc/engineering-computer-ase/)
- Engineering, Electrical - Associate in Science in Engineering (https://catalog.ccri.edu/programs-study/physics-engineering/assoc/engineering-electrical-ase/)
- Engineering, Industrial - Associate in Science in Engineering (https://catalog.ccri.edu/programs-study/physics-engineering/assoc/engineering-industrial-ase/)
- Engineering, Mechanical - Associate in Science in Engineering (https://catalog.ccri.edu/programs-study/physics-engineering/assoc/engineering-mechanical-ase/)
- Engineering, Ocean - Associate in Science in Engineering (https://catalog.ccri.edu/programs-study/physics-engineering/assoc/engineering-ocean-ase/)

Certificates

- Advanced Manufacturing and Design, Advanced Manufacturing and 3D Prototyping - Certificate (https://catalog.ccri.edu/programs-study/physics-engineering/cert/engineering-systems-technology-CNC-manufacturing-3D-modeling-certificate/)
- Advanced Manufacturing and Design, Manufacturing and Design - Certificate (https://catalog.ccri.edu/programs-study/physics-engineering/cert/engineering-systems-technology-introduction-CNC-manufacturing-certificate/)
- Geographic Information Systems (GIS) - Certificate (https://catalog.ccri.edu/programs-study/physics-engineering/cert/geographic-information-systems-certificate/)

JAA Transfer Degrees

- Physics Transfer, Geology and Geological Oceanography BS - Associate in Arts (URI) (https://catalog.ccri.edu/programs-study/physics-engineering/transfer/geology-oceanography-bs-uri/)
- Physics Transfer, Physics BS - Associate in Arts (URI) (https://catalog.ccri.edu/programs-study/physics-engineering/transfer/physics-bs-uri/)

Courses

Engineering (ENGR)

ENGR 1020 - Introduction to Engineering & Technology
(3 Credits)
This course introduces students to various tools and problem solving skills common to most fields of engineering and technology. The course will emphasize developing both individual critical thinking, and collaborative problem solving skills, essential in today's world of technology. Students will learn the basics of the engineering design process of product design, testing and evaluation. As teams, students will apply this process to complete a semester-long project that will involve practical problem solving, computer simulation and physical product fabrication. To assist in the project analysis, documentation and presentation, students will develop skills with spreadsheets, word processing and presentation software.

Lecture: 2 hours, Lab: 2 hours

Prerequisite(s): MATH 0600 (may be taken concurrently) or MATH 0095 or MATH 0101 (may be taken concurrently) or MATH 0100 or Math Placement or (Bachelor Degree or higher)

URI/RIC Transfer General Education Transfer Opportunity: Yes

ENGR 1030 - Engineering Graphics
(3 Credits)
This course studies the theory of orthographic projection and the principles of descriptive geometry. Students construct exact drawings of three-dimensional objects including auxiliary views, cross-sections, dimensioning, pictorial drawings and free-hand sketching.

Lecture: 2 hours, Lab: 2 hours

ENGR 2050 - Engineering Mechanics Statics
(3 Credits)
This is a basic course built around solutions and applications of Newton's laws of forces in equilibrium. Systems of particles and rigid bodies are studied using standard scalar and vector methods.

Lecture: 4 hours

Prerequisite(s): (MATH 1910 or MATH 2141)

ENGR 2060 - Engineering Mechanics Dynamics
(3 Credits)
This course covers the application of Newton's law of motion, to include kinematic and kinetic studies of the motion of systems of particles and rigid bodies, acted upon by unbalanced forces.

Lecture: 3 hours

Prerequisite(s): ENGR 2050 and (MATH 1920 or MATH 2142)

ENGR 2160 - Introduction to Engineering Analysis
(2 Credits)
This course introduces students to analytical methods employed in engineering problem solving using computer software.

Lecture: 3 hours

Prerequisite(s): MATH 1910 (may be taken concurrently) or MATH 2141 (may be taken concurrently)

ENGR 2320 - Digital Electronics
(4 Credits)
This course studies logical building blocks and functional building blocks such as OR gates, AND gates, inventors, XOR gates, registers, counters, adders, D/A converters, A/D converters, decoders, encoders and binary multiplexers. Number systems and codes, arithmetic processes and memory devices are also covered. Input, output, memory, control and arithmetic functional units are developed using functional building-blocks. Note: Engineering students should consult department chair or academic advisor before enrolling.

Lecture: 3 hours, Lab: 3 hours

Prerequisite(s): MATH 2141 (may be taken concurrently)

ENGR 2520 - Microprocessor & Microcomputers
(4 Credits)
This hands-on course familiarizes students with computer and microprocessor software and hardware. Computer architecture and interfacing with input and output devices is studied. Students develop an understanding of how the computer is used to control electronic and mechanical devices.

Lecture: 3 hours, Lab: 3 hours

Prerequisite(s): MATH 2141 (may be taken concurrently) or MATH 1910 (may be taken concurrently)

ENGR 2540 - Mechanics of Materials for Engineering
(3 Credits)
This is a basic study of the theory of stresses and strains in beams, columns and thin-walled cylinders including combined bending and direct stresses.

Lecture: 3 hours

Prerequisite(s): ENGR 2050

ENGR 2620 - Linear Electrical Systems and Circuit Theory for Engineers
(3 Credits)
This course offers a study of electrical linear circuit theorems, Kirchhoff's Laws, DC resistive networks, dependent sources, natural and forced response of first and second order circuits, sinusoidal steady-state response and AC power.

Lecture: 3 hours

Prerequisite(s): (ENGR 2150 or PHYS 1500) and (MATH 2990 (may be taken concurrently) or MATH 2362 (may be taken concurrently))

ENGR 2621 - Linear Circuits Lab
(2 Credits)
Topics covered in this lab include: DC measurements, natural and step response of first and second order circuits, AC measurements, impulse and frequency response and operational amplifiers.

Lecture: 1 hour, Lab: 3 hours

Prerequisite(s): ENGR 2620 (may be taken concurrently)

Engineering Technology (ENGT)

ENGT 1060 - AutoCAD (Basic)
(2 Credits)
This course develops the fundamental skills in drawing, presenting and interpreting ideas, shapes, and concepts using the graphic language of AutoCAD. This course provides practice in the use of Computer Aided Drafting, a technology that has impacted the way many products are designed and produced. Students will explore all the necessary commands needed to produce orthographic drawings and construction type drawings using micro-computers.

Lecture: 1 hour, Lab: 2 hours

ENGT 1200 - Introduction to Wireless
(3 Credits)
This course introduces wireless networking over a range of applications, from cell phones to wireless local area networks (WLAN), to broadband wide area network links and satellite. Topics covered include an overview of wireless communication technology, protocol layers, local area network (LAN) hardware, IP addressing, 802.11 standards, MAC (Media Access Control) standards, WLAN components, basic security, basic RF theory, antennas and troubleshooting. The student will have hands-on experience with various LAN and WLAN networking components, applications, tools and projects.

Lecture: 2 hours, Lab: 2 hours

ENGT 2090 - Advanced Solid Modeling
(3 Credits)
Advanced Solid Modeling will enable the student to work with advanced designs and assemblies. This will include mold design, sheet metal design, weldments, and industry specific design tools. The students will learn to use COSMOSWorks to study deflections and load stress on their designs. Other applications would include rendering in PhotoWorks and animation techniques.

Lecture: 2 hours, Lab: 2 hours

Prerequisite(s): ENGR 1030

Engineering Technology - CNC (ETCN)

ETCN 1100 - Blueprint Reading and the Machinery's Handbook
(3 Credits)
Detailed manufacturing part prints are the graphical representation of what the finished product should look like and the specifications required to make it. The Machinery's Handbook is the encyclopedia used in the manufacturing environment; a storehouse of practical information used to assist not only CNC machinists, but also quality control personnel, tool or mold makers, machine designers and mechanical engineers to solve a list of manufacturing problems. This course uses these two resources to teach students how to interpret the language of blueprints and find the required information regarding machining processes such as speeds, feeds, cutting tool specifications and limits. The focus is on problem-solving skills and strategies.

Lecture: 2 hours, Lab: 2 hours

ETCN 1200 - Precision Measurement and Geometric Dimensioning and Tolerance
(3 Credits)
This course is designed to develop the student's ability to interpret Geometric Dimensioning and Tolerancing (GD&T) language and accurately and precisely measure manufactured parts and assembles using micrometers, digital calipers and dial indicators. Language and systems of measurement and GD&T are studied and discussed. Basic handheld comparison tools, precision gages, scaled and precision measuring tools are used to accurately measure parts for both size and geometric form. Students also learn about sine bar use and setup, gage blocks care, surface plate preparation and part fixturing. The feature control frame the geometric symbols in the application of the tolerances are also studied.

Lecture: 2 hours, Lab: 2 hours

Prerequisite(s): ETCN 1100

ETCN 1300 - CNC Machining I
(3 Credits)
This course introduces students to CNC programming using flow charts and process operations planning. Fundamental word address (G and M code) industrial standards, practices and terms used in industry are covered. Machine tool axis motion, methods of work piece setup cutting tool, selection cutting tool compensation and canned cycles are reviewed. Students produce manually written part programs for three axis-milling machines and router, and two axis lathes. Review of blueprints, Geometric Dimensioning and Tolerancing (GD&T) terminology, and right angle trigonometry are covered. Students will set-up and operate CNC milling machines and lathes to make assigned parts.

Lecture: 1 hour, Lab: 4 hours

Prerequisite(s): ENGR 1030 (may be taken concurrently) and ETME 1020 (may be taken concurrently) and ETCN 1100 (may be taken concurrently)

ETCN 2100 - Computer Aided Manufacturing
(3 Credits)
In this seven-and-a-half week course, students study the essentials of a computer-aided manufacturing system (CAM). This course uses MasterCam, which is an industrial software application, used to draw and create a tool path for CNC machining applications such as milling and turning. Students use CAM software in conjunction with computer-aided drawing files (CAD) to create machined features from a piece of stock material. Topics include using MasterCam to select the correct CNC machine tool, draw solid models, organize and optimize machining operations and time.

Lecture: 1 hour, Lab: 4 hours

ETCN 2200 - CNC Machining II
(3 Credits)
This course is a continuation of the CNC Machining I and Computer-Aided Manufacturing courses. In this course, students will use MasterCam to create toolpaths and code for 3 and 4 axis CNC milling machines and 2 axis CNC lathes. ISO codes will also be written for the 5 axis wire EDM using MasterCam as well as imported files from SolidWorks and AutoCAD. Additionally, students will set up and machine assigned parts on 3 and 4 axis CNC mills, 2 axis CNC lathes and the 5 axis wire EDM.

Lecture: 1 hour, Lab: 4 hours

Prerequisite(s): ETCN 1300 (may be taken concurrently) and ETCN 2100 (may be taken concurrently)

ETCN 2300 - 3D-Modeling and Prototyping
(3 Credits)
This course will study the types of Additive Fabrication (AS) or Additive Freeform Fabrication, as it is called in the industry. Topics include the history of Additive Manufacturing, the types of new generation machines used for A.M., and the types of materials, binders, and substrates used with this technology. Other topics include the size constraints, design constraints, and advantages and applications of this technology. The student will use SolidWorks and MasterCam as the manufacturing software to design and produce parts in the manufacturing lab using the Dimension SST 1200es CNC machine tool.

Lecture: 2 hours, Lab: 2 hours

Prerequisite(s): ENGR 1030 (may be taken concurrently) and ENGT 2090 (may be taken concurrently)

ETCN 2400 - Industry and OSHA-10 Seminars
(1 Credit)
Working safely and a safe working environment are the highest priorities. Students will gain an understanding of OSHA and important details concerning a safe workplace, and will earn the OSHA 10-hour card. The OSHA 10-hour card shows employers the student has had a good introduction to the safety concerns foremost in today's general industry workplace. This course will also provide networking opportunities with advanced manufacturing companies using the skills learned and developed in the certificate and A.S. degree programs. Industry leaders visit students in the classroom, describing the growing advanced manufacturing market, and how their skills can be integrated.

Lab: 3 hours

ETCN 2500 - Computer Numerical Control (CNC) Practicum/Capstone^
(4 Credits)
This course gives students an opportunity to apply knowledge and skills learned in the CNC certificate program in an industrial setting. Students spend 140 hours in a manufacturing environment setting up and operating CNC machine tools under the guidance of full-time employees. This class also has a two-hour meeting requirement which is used to develop a portfolio outlining the types of working experiences acquired in the practicum. Students keep a working journal during the semester which will be used to assist in building their portfolio to chronicle their experience in order to address any problems or concerns that may arise. The Engineering Department provides assistance in matching students in practicum settings.

Lecture: 1 hour, Other: 9 hours

Prerequisite(s): ETEE 1800 (may be taken concurrently) or (ETCN 2100 (may be taken concurrently) and ETCN 2200 (may be taken concurrently) and ETCN 2300 (may be taken concurrently))

Engineering Technology - Electrical (ETEE)

ETEE 1050 - Introduction to Electromechanical Systems
(3 Credits)
The course will introduce the student to the nature of electricity and magnetism, and applications of practical electrical and electromechanical devices and systems. Students will study electrical laws in basic DC and AC circuits, and the behavior of passive and active circuits and components. Students will also be introduced to basic electromechanical components such as relays, switches, motors and generators. The course will emphasize a systems approach to utilizing and testing electromagnetic technology. Both hands-on labs and software simulation will be used to develop an understanding of combining components to form complex systems and the techniques to evaluate the performance of electromechanical systems.

Lecture: 2 hours, Lab: 2 hours

Prerequisite(s): MATH 1179 (may be taken concurrently)

ETEE 1100 - Engineering Applications of Computers
(3 Credits)
Students will be introduced to microprocessor and microcontroller architectures. Machine, assembly, and high-level languages will be examined. A combination of assembly and a high-level language will be applied to solving problems using a popular microcontroller development environment and target hardware system. Data and graphic information types and formats will be described and used in programs. Acquiring data from internal and external sources, communicating across networks, and directing output to displays and other external interfaces will also be explored. Student lab activities include developing and debugging programs used to control electromechanical devices, measuring operating parameters, collecting data, and displaying information.

Lecture: 2 hours, Lab: 2 hours

Prerequisite(s): (MATH 1750 (may be taken concurrently) or MATH 1179) and ETEE 1800

ETEE 2500 - Electrical Systems II (Formerly ETEK 2370-Technical Capstone Project)
(3 Credits)
Switching devices including SCRs, TRIACS, DIACS, UJT, and their application in power and motor control circuits are covered in this course. The application of transducers as sensors in industrial control systems is also covered. Use of programmable controllers in industrial control of processes and power circuits is emphasized. The laboratory experiments include SCR and switching devices in the control of power circuits; application of sensors for measurement of heat, position, stress, light and pressure; operation and programming of programmable controllers; measurements in single phase and three phase -Y power circuits, and the operation of motors. Students will apply material learned in this course and in previous courses to a capstone project.

Lecture: 2 hours, Lab: 2 hours

Prerequisite(s): ETEE 1500

Engineering Technology - Mechanical (ETME)

ETME 1020 - Introduction to Manufacturing Processes
(3 Credits)
This course provides students with insight and practical experiences in the set-up and operation of basic machines and measuring tools used in manufacturing processes. Significant emphasis is placed on dealing safely with high power machinery, materials, laboratory clothing and machine maintenance. Turning, milling, grinding, drilling and precision measurement are covered, developing students' ability to fabricate mechanical components using traditional machining. Students learn the limitations of traditional machining and prepare for understanding advanced manufacturing technology.

Lecture: 1 hour, Lab: 4 hours

ETME 2500 - Mechanical Systems II (Capstone)
(3 Credits)
The purpose of this course is to teach the student how mechanical components are combined and intergraded into complex working systems. The course will stress building assemblies and harnessing electrical controls to the assemblies. This course is designed to cement together the knowledge learned in previous courses within the program. Students will learn to create operational sequences, build systems from standard components, write programs to control them, apply necessary sensors and actuators, and operate and debug their assemblies.

Lecture: 2 hours, Lab: 2 hours

Prerequisite(s): ETME 1010 and ETME 1500

ETME 2930 - Industrial Materials
(3 Credits)
This course is an introduction to the different material systems in material science. This course includes an introduction to the structure and properties (such as mechanical, chemical, and physical properties) of materials, specifically metals. Equilibrium phase diagrams and isothermal diagrams are also introduced. This course also introduces various techniques of materials testing such as tensile, creep, bend, hardness, impact, and fatigue testing. Also covered are various techniques of heat treatment such as annealing. This course examines the factors that influence the production and modification of materials into useful forms. Students learn about the various manufacturing processes and machinery used to convert raw materials into finished products. The course gives the student "hands on" experience with materials and processes used in industry. A lab is also utilized to demonstrate various techniques.

Lecture: 2 hours, Lab: 2 hours

Prerequisite(s): (MATH 1200 and MATH 1210 or MATH 1179 and MATH 1181) and ETME 1510

Process Control Technology (INST)

INST 1010 - Introduction to Instrumentation Technology
(3 Credits)
This course stresses the theory and practical application of mechanical and electrical sensing devices and control systems. Topics covered include sensing and control devices for temperature, humidity, pressure, level and flow. In addition, calibration procedures are covered.

Lecture: 2 hours, Lab: 2 hours